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NEUTRON SCATTERING –A VERSATILE TOOL TO BETTER UNDERSTAND PHOTOSYNTHETIC ADAPTATION, YOGURT FERMENTATION AND CHILI DELIVERY

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Structural characterisation of biologically and biotechnologically relevant complex systems –using small-angle neutron scattering –is one of the research areas at the Neutronspectroscopy Department of the Wigner Research Centre for Physics and at the Budapest Neutron Centre. Here we demonstrate this through few selected examples.

Our team has been investigating the structure and structural flexibility of photosynthetic membrane assemblies for many years. The range of samples extends from isolated thylakoid membranes through living algal cells to intact leaves. Monitoring the nature and extent of stress-induced membrane reorganisations is a key step towards the understanding the mechanism of stress responses in vivo. Small-angle neutron scattering (SANS), as a non-invasive technique, allowed us to reveal ultrastructural changes in different photosynthetic membranes under a large variety of abiotic and biotic stresses. Revealing the dynamic response of the system to illumination with varying intensity [1] and spectral composition [2] allowed us to better understand the photoprotective mechanisms in actions, while structural variations as a result of heavy metal ions or the trace elements [3] shed light to the influence of these pollutants on the photosynthetic organisms.

SANS–a technique often applied to follow the sol-gel transformation of fermented dairy products –also helped us to characterize the influence of transglutaminase (mTG) on the fermentation process of bovine milk, and to demonstrate how mTG helps to retain the whey protein in yoghurt [4].

Our group has also performed experiments on red chili pepper extract, which is used both as a food ingredient and a natural remedy for various medical conditions. Our scattering experiments provided information on the nanoscale pore characteristics of polyurethane microparticles, which can be used to entrap the extract in order to diminish its irritative potential [5].

In the last example, I will discuss our recent results on high fat oil-in-water emulsions. With scattering measurements enabled us to characterize the interfacial structure of this system and the interaction between the applied emulsifiers sodium caseinate and phosphatidylcholine [6]

References:

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[5] L.-C. Borcan, Int. J. Nanomedicine, 2018, 13, 7155-66.

[6] B. Yesiltas et al., submitted to J. Colloid. Interface. Sci.

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